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An Analogue of the Cupric-Ammonia Ion in Acetic Acid Solution

Abstract of Paper 37 of the 1927 Meeting at Lawrence

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Cupric acetate dissolved in glacial acetic acid may be considered as analogous to cupric hydroxide in aqueous solution, the solute having in each case the same anion as the solvent. The solubiltiy of cupric acetate in acetic acid is small, the saturated solution having a bluish green color. When ammonium acetate is added, the solubility of the cupric salt is greatly increased, (as in the corresponding case of cupric hydroxide and ammonium hydroxide in aqueous solution), and the color of the solution changes to blue. Even more striking is the fact that on heating the solution of cupric acetate and ammonium acetate in acetic acid, its color deepens and also changes somewhat toward the violet, until it becomes practically identical with that of an aqueous solution containing the so-called cupric- ammonia ion.

Either this similarity in color is entirely fortuitous, which seems improbable, or else the color of the acetic acid solution is to be regarded as being due to the presence of cupric-ammonia ion, which at first sight appears unlikely also, since this solution contains a large excecss of the acid. But as a matter of fact it is entirely possible for free ammonia to be present in acetic acid solution at elevated temperatures, just as it is in water, to a considerable extent, at ordinary temperatures; and ammonia can be distilled off along with acetic acid from such solutions. It was shown experimentally, for instance, that a solution containing 75 grams of acetic acid, 25 grams of ammonium acetate and 2 grams of cupric acetate began to lose ammonia at 135° to 140° C. (as indicated by the presence of a perceptible quantity of ammonia in the distillate collected between these temperatures). At 135° C., also, the color of the solution exactly matched that of an aqueous solution containing the cupric-ammonia ion.

It is, then, altogether reasonable to conclude that the deep violet-blue color of such a solution is due to an ion very similiar in its nature to that which give rise to it in aqueous solutions. The problem is being studied further in this laboratory.